Earth Science Technology Program

George J. Komar

Earth Science Technology Program

- TST Terms of Reference
- Integrated Technology Development Plan
- Baseline Mission Profile Studies (Scenarios)
- Solicitation Schedule

TST Terms of Reference

Background

The Technology Strategy Team (TST) was originally chartered to provide support and inter-center coordination for ESE technology planning efforts. Many of the original responsibilities of the TST are now being served by the Earth Science Technology Office (ESTO), which was formed in 1998, to manage the Earth Science Technology Program (ESTP) for NASA Headquarters. The original terms of reference (August 5, 1997) of the TST has served its purpose of initiating the planning process.

The purpose of the TST is to advise the ESE Lead Technologist and ESTO in the planning and implementation of the ESTP. Its secondary purpose is to provide coordination between NASA centers on the ESE program.

TST Terms of Reference

Functions and Responsibilities

· TST will meet regularly to review near-term and long-term plans of the ESTP to assess

1. Responsiveness of the ESTP to future ESE need,
2. Processes used by ESTO in determining those needs,
3. Implementation strategies, and
4. Processes to assure proper leveraging of other activities outside ESE.

· TST will advise the ESE Lead Technologist and the ESTO Program Manager on topics of interest and/or issues.

· TST members will serve as representatives to the ESTP, and will coordinate the ESTP with their home organizations.

TST Terms of Reference

Membership

· TST will consist of representatives from ESE Elements, NASA Centers, NASA technology programs and external organizations engaged in development of technologies pertinent to future ESE needs.

· TST members shall be appointed by their organization and shall be chosen for their ability to represent the technology plans in their home organization that may require coordination and integration with the ESTP.

· TST members are expected to attend all TST meetings or designate an alternate. It is paramount that all Center or participating organizational views be represented.

· Members of the TST will be appointed by the heads of their home organizations (e.g., Center Directors) or programs. Should organizational responsibilities change in the future or TST needs change to the extent that different representation would improve the capability of the TST, the organization heads will be informed of the situation and asked to appoint a representative who better serves the needs of the team.

TST Terms of Reference

Meetings

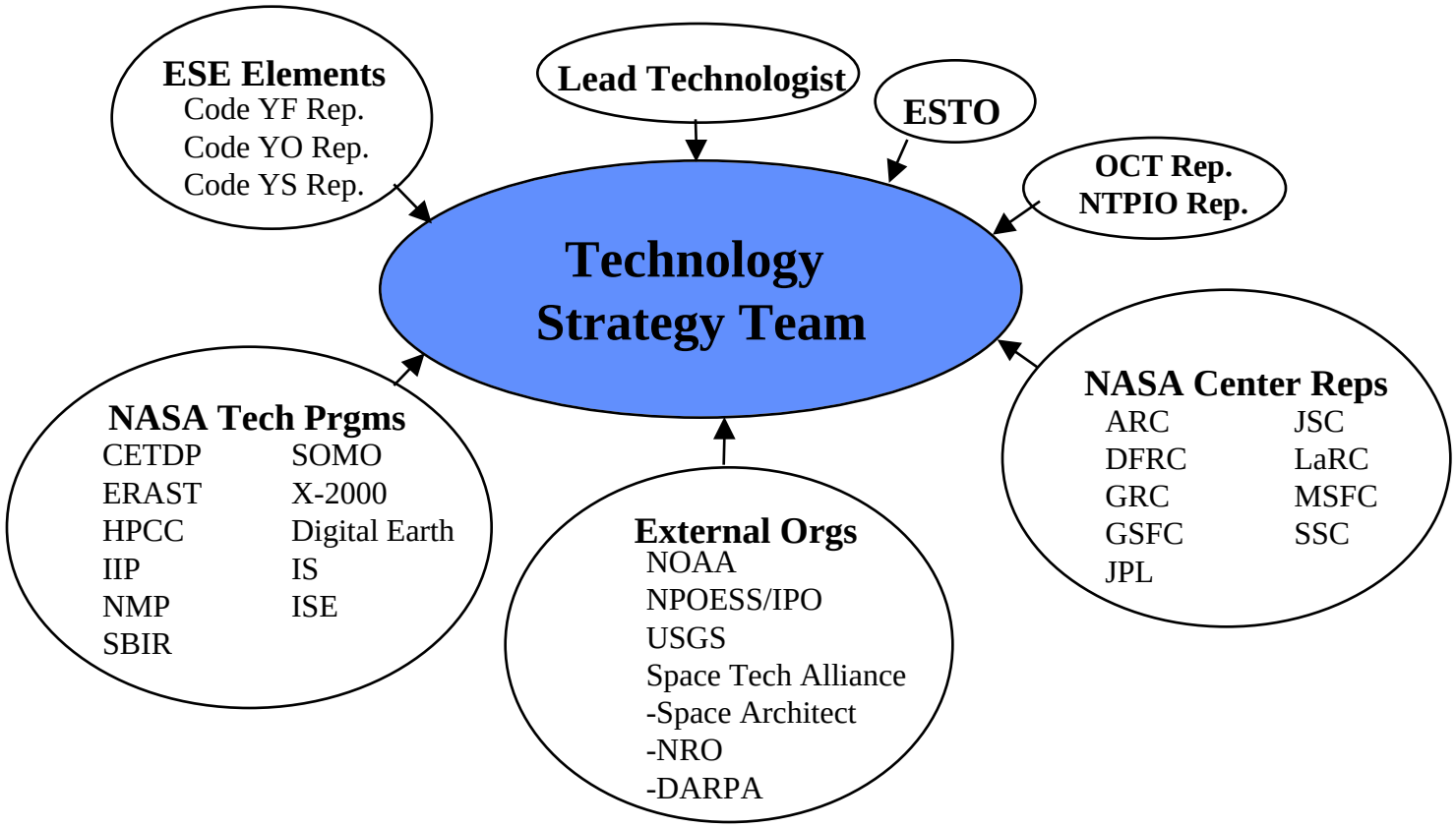
· Meetings will nominally be held quarterly at selected sites.

· The Lead Technologist or ESTO Program Manager may provide a key topic or question on which review, assessment and recommendation is requested.

· The ESTO Program Manager will conduct the TST meetings and will routinely report actions/ progress made from prior TST meetings.

· Meetings will normally be open to all interested parties.

Technology Strategy Team Participants



Integrated Technology Development Plan

- Describes technology advancements needed to enable future programs
- Incorporates new technologies into ESE programs in the
  - near-term, over the next 3 years;
  - mid-term, 4 to 6 years from now; and
  - far-term, 7 to 10 years from now.
- Describes the investments needed over a six year horizon (FY 2000 to FY 2005)
- Built around 3 product lines: Instruments, Platforms and Information Systems and supported across product lines by Advanced Technology Initiatives
- Focuses science and application requirements
- Advances component, subsystem and system development
- Leverages technology development within NASA, with other government agencies, industry, academia and international partners

Integrated Technology Development Plan

- **Example near and mid-term:**
  - **Support measurements of topography and surface change using synthetic aperture radar**
  - **Precipitation measurements using a smaller, lower powered radar for a global precipitation mission (TRMM follow-on)**
- **Example far-term:**
  - **Support instrument, platform and advanced information systems that will perform formation flying of micro-spacecraft**
  - **Enable integration of simultaneous data sets from sensor webs**

ITDP Outline

Investment Strategy

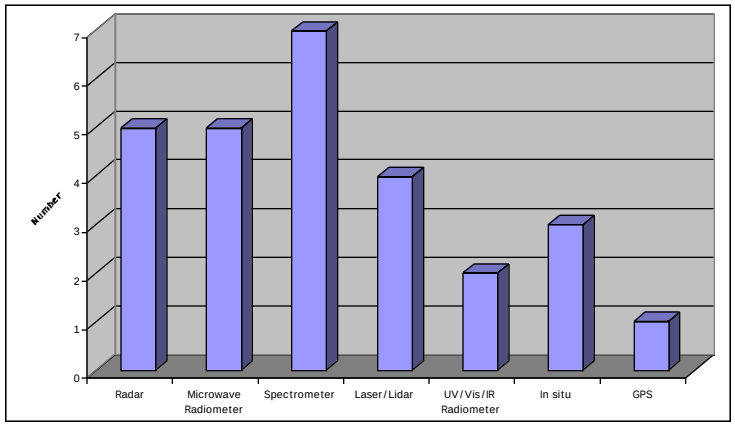
- 1.0 Introduction
- 2.0 Instrument Technology
  - 2.1 Instrument Incubator
  - 2.2 Advanced Technology Initiatives for Instruments
  - 2.3 Instrument Advanced Concepts
- 3.0 Platform Technology
  - 3.1 Current Platform Technology Program
  - 3.2 Advanced Technology Initiatives for Platforms
  - 3.3 Platform Advanced Concepts
- 4.0 Information Systems Technology
  - 4.1 Advanced Information Systems Technology Program
  - 4.2 Advanced Technology Initiatives for Information Systems
  - 4.3 IT Advanced Concepts

Investment Portfolio

- Appendices
  - Total Portfolio
  - Instrument Portfolio
  - Platform Portfolio
  - Information Systems Portfolio

Instrument Technology

CURRENT INVESTMENTS (IIP)



FUTURE INVESTMENTS (IIP)

Post-2002 Notional Mission / Science/ Application Area	EOS-1	EOS-2	EOS-3	EOS-4	EOS-5	EOS-6	EOS-7	EOS-8	EOS-9	EOS-10	EX-1	EX-2	EX-3	EX-4	EX-5	EX-6	EX-7	OP-1	OP-2	OP-3	OP-4	OP-5	OP-6	OP-7
ATMOSPHERIC CHEMISTRY																								
Stratospheric Chemistry							√																	
Tropospheric Chemistry											√													
ATMOSPHERIC PHYSICS																								
Aerosol Properties												√												
Temperature and Humidity		√																√		x	x			
Cloud Properties													x											
Radiative Energy Fluxes																								
Total Solar Irradiance				x																				
GEODYNAMICS / GEOLOGY																								
Surface Deformation Mapping								x																
Gravity Field Mapping															x									
Magnetic Field Mapping																								
GLOBAL WATER CYCLE																								
Cloud Hydrologic Process									√															
Precipitation									√															
Soil Moisture														√										
Snow Cover																x								
Tropospheric Wind																			x					
LAND COVER / ECOSYSTEMS																								
Land Cover and Land Use Change	√		√																					
Vegetation Disturbance Recovery																√								
NATURAL HAZARDS																								
Lightning																								x
Volcanic Ash Cloud																						x		
Fire Occurrence																						x	x	
Severe Storm Assessment																						x		
Flood Characterization																							x	
OCEAN AND ICE																								
Ice Sheet Mass Balance										√														
Ocean Color Mapping			√																				x	
Ocean Surface Topography						√																		
Ocean Surface Wind				√																				
Sea Surface Salinity														√										
Ocean Surface Temperature																								

ADVANCED TECH INITIATIVES

- Lasers - 1& 2 micron
- Microwave Radiometers - lightweight microstrip
- Multi/hyperspectral Spectrometers - ultra-wide FOV
- GPS - parallel processing
- Synthetic Aperture Radar - P-band
- SBIR - 10 lidars; 2 SAR

ADVANCED CONCEPTS

- ESE Vision
- NIAC-funded Studies
  - Biological sensors
  - Large ultra-lightweight deployable structures
  - Ultra-high resolution imaging
  - Large aperture systems
  - Rapid, low-cost sensor production

Platform Technology

CURRENT INVESTMENTS

- None

FUTURE INVESTMENTS

- Spacecraft - Rad hardening
- Airborne - UAV Autonomy
- Balloons - GN&C
- Penetrators - Shock mitigation
- Buoys - Communications
- The Moon - Continuous power systems

ADVANCED TECH INITIATIVES

- ATI: Reprogrammable gate arrays
- Options: Formation flying
- SBIR: GPS guidance; electro-mechanical systems
- CETDP: Micro/nano sensorcraft; distributed spacecraft; ultra lightweight structures
- External: Commercial
- Internal: NMP/X-2000

ADVANCED CONCEPTS

- Sensorcrafts
- Sensor webs

Information Systems Technology

CURRENT INVESTMENTS (Prototyping)

- Interactive Access
- Open Distributed Architecture
- Storage Management Technology
- Prototype Management & Assessment
- Automated Systems Operations
- Network Prototypes

FUTURE INVESTMENTS (AIST)

- Data Collection Process
- Systems Management
- Transmission
- Infrastructure
- Analysis, Search & Display
- Data & Information Production

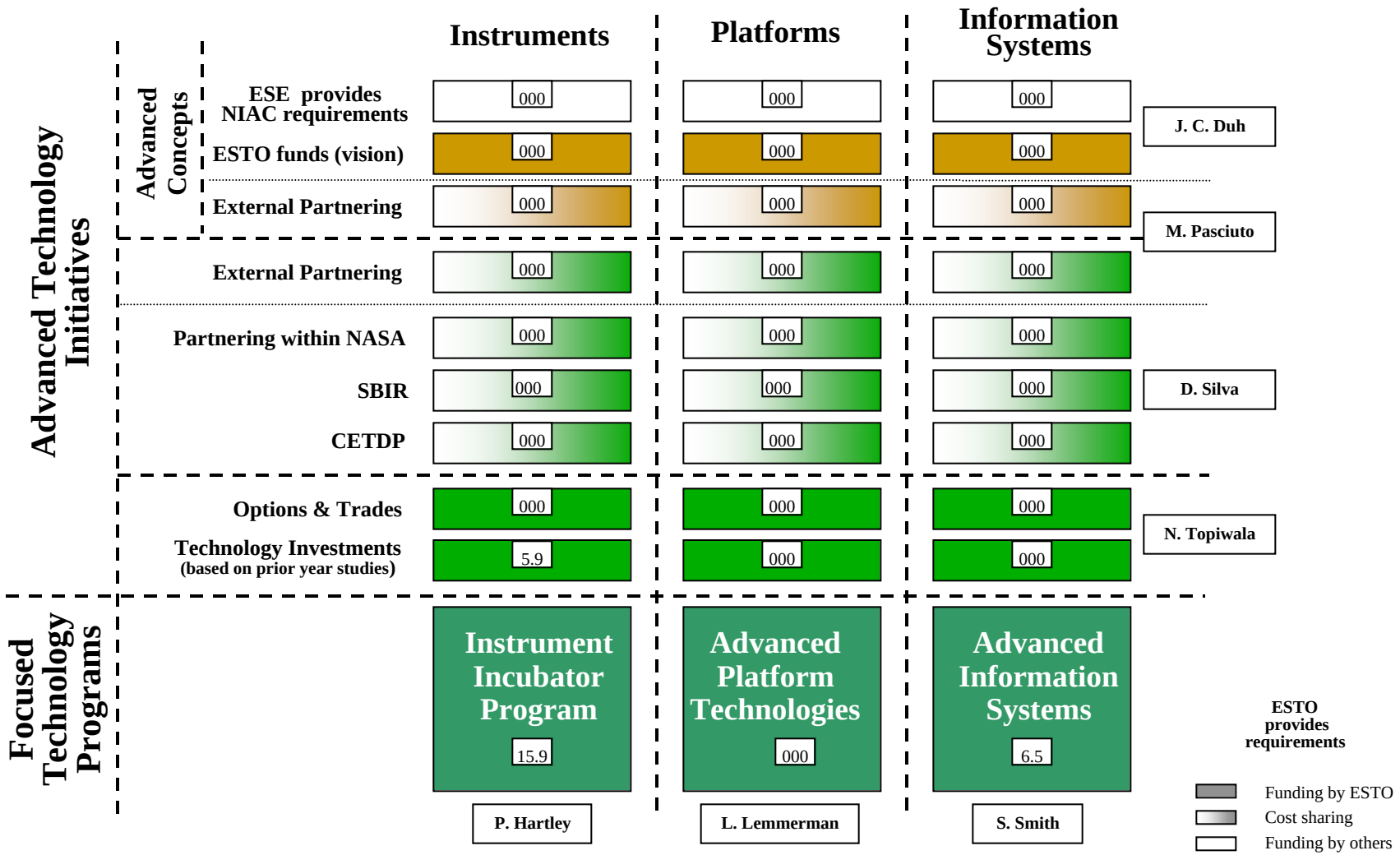
ADVANCED TECH INITIATIVES

- Onboard data processing
- Communications
- Intelligent data extraction
- Optical and data compression
- Formation Flying
- CETDP: Image mining: high rate rad hard digital modem
- External: Internet Protocol (IP) v6

ADVANCED CONCEPTS

- ESE Vision
  - Autonomous, reconfigurable, adaptable, interactive sensor webs
  - Intelligent agents and sensors with pattern recognition
  - Neural networking
  - AI capabilities

Integrated Technology Development Plan FY 99



Integrated Technology Development Plan

Example Record

<1 of 3>

Project Name	In Situ
Technology	
Investment Horizon	☐ Near-term ☒ Mid-term ☐ Far-term ☐ Future
Contact	Pepper Hartley

Executive Summary

There are projects addressing airborne in situ measurements of SO2, NOx, and other trace gases using laser-induced fluorescence and gas chromatography/mass spectrometry.

FY99 Budget	FY00 Budget	FY01 Budget	FY02 Budget	FY03 Budget	FY04 Budget	FY05 Budget
$0.8	$1.6	$0.6				

TRL 99	TRL 00	TRL 01	TRL 02	TRL 03	TRL 04

Example ITDP Planning Format

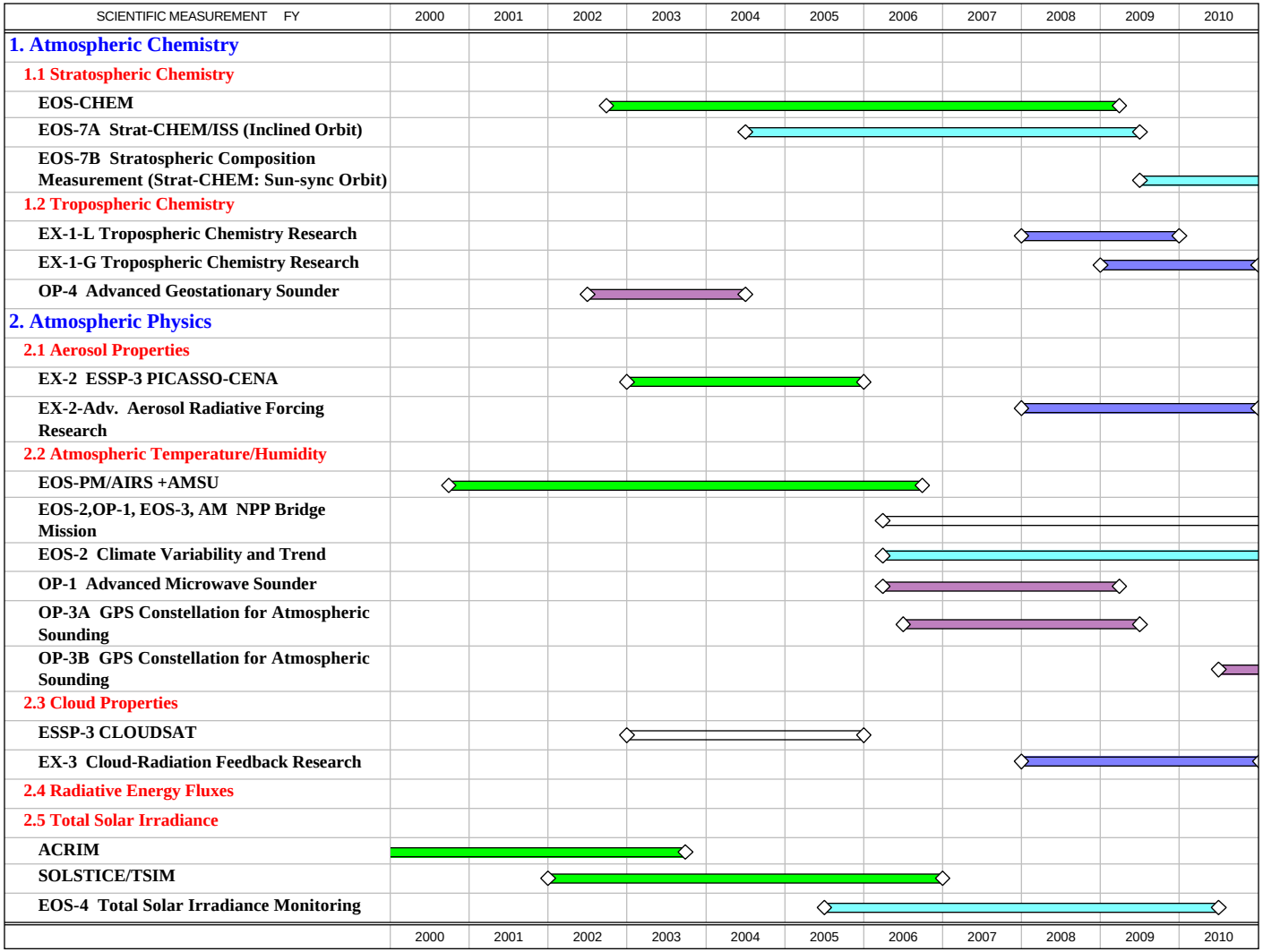
Program		FY99	FY00	FY01	FY02	FY03	FY04	FY05
Advanced Tech. Initiatives	Summary	$5.9	$8.9	$10.0	$10.5	$11.0	$12.0	$12.0
							8.5	$8.5
							1.5	$1.5
							2.0	$2.0
Inst							2.0	$22.0
							22.0	$22.0
Adv							5.5	$16.0
	Prototyping	$6.5						
	Data Collection Process		$3.8	$2.6	$2.1	$1.9	$1.9	$2.0
	Systems Management		$3.8	$2.6	$2.1	$1.9	$1.9	$2.0
	Transmission		$1.9	$2.6	$2.8	$3.8	$3.9	$4.0
	Infrastructure		$1.2	$2.6	$4.2	$4.5	$3.9	$4.0
	Analysis, Search & Display		$1.0	$1.3	$1.4	$1.5	$1.9	$2.0
	Data & Information Production		$0.9	$1.3	$1.4	$1.5	$1.9	$2.0

$15.0

ITDP Development Schedule

• Outline	3/26/99
• Rough Draft	4/16/99
• Draft Version	5/14/99
• TST Comments	5/28/99
• TSC	6/4/99
• Final Version	6/30/99

ESE Measurement Scenarios (BMPS)



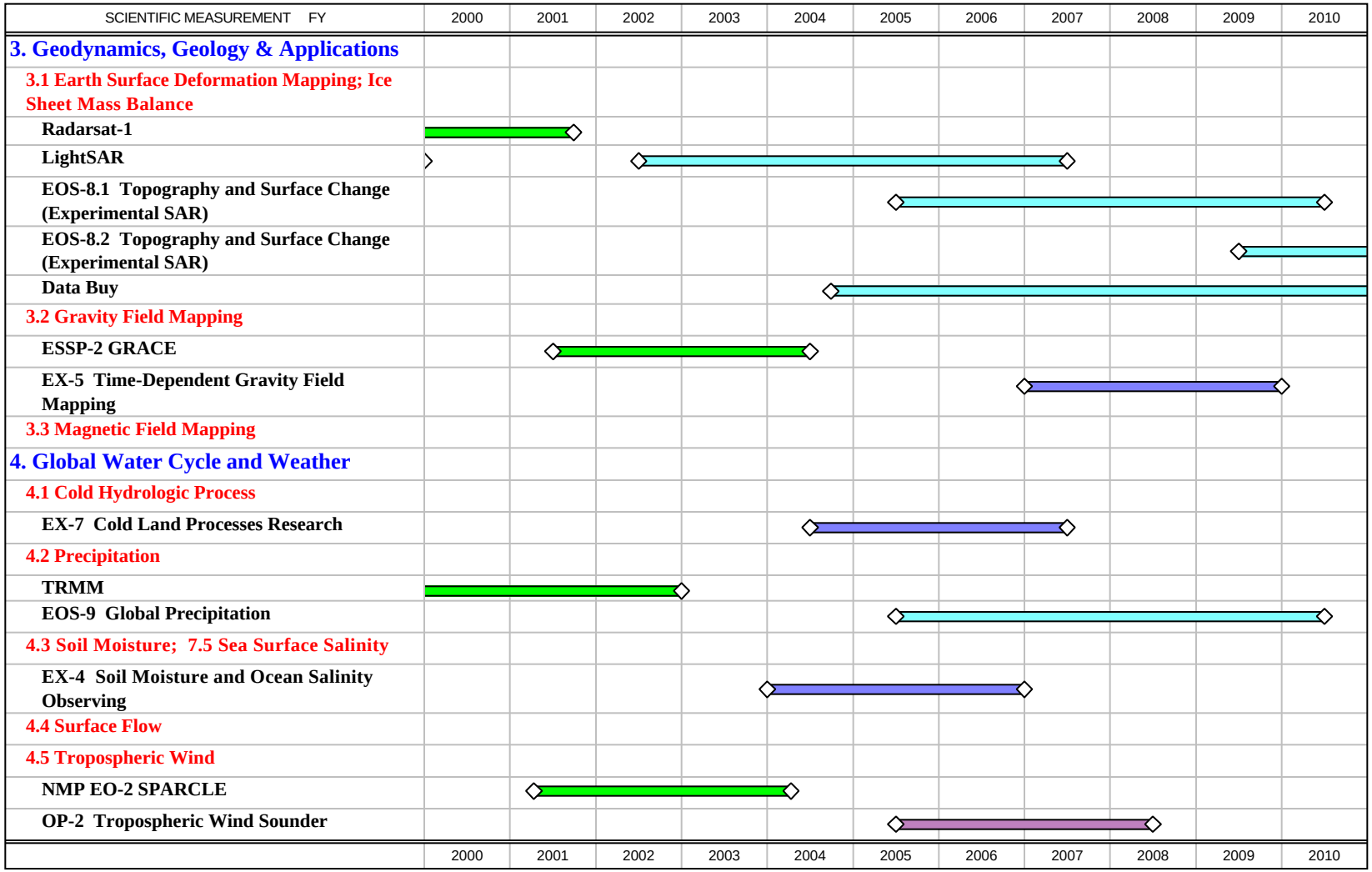
Current

EX - Earth Probe Exploratory/Focused

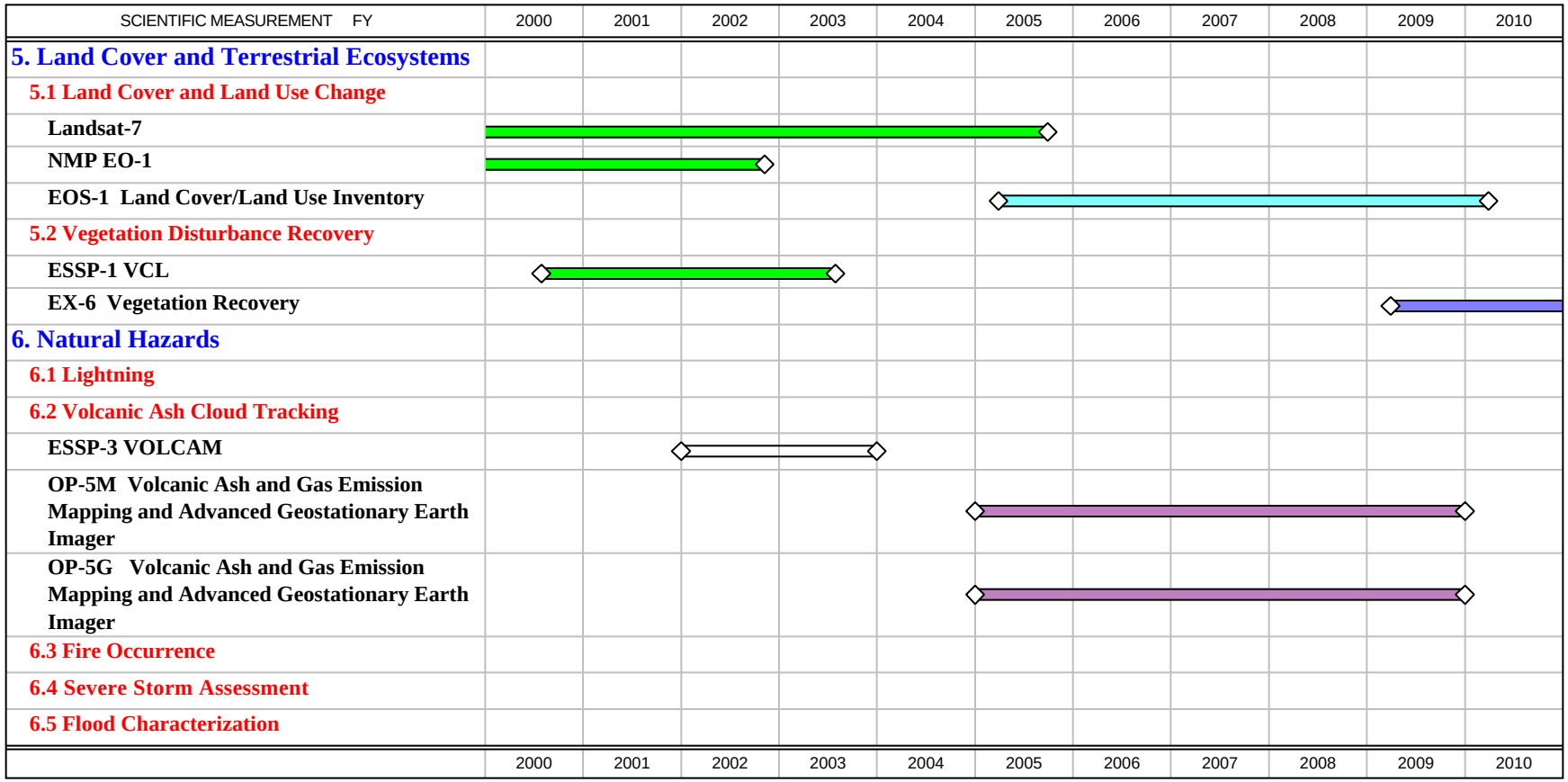
EOS - Systematic

OP - Pre-operational

ESE Measurement Scenarios (BMPS)



ESE Measurement Scenarios (BMPS)



Current
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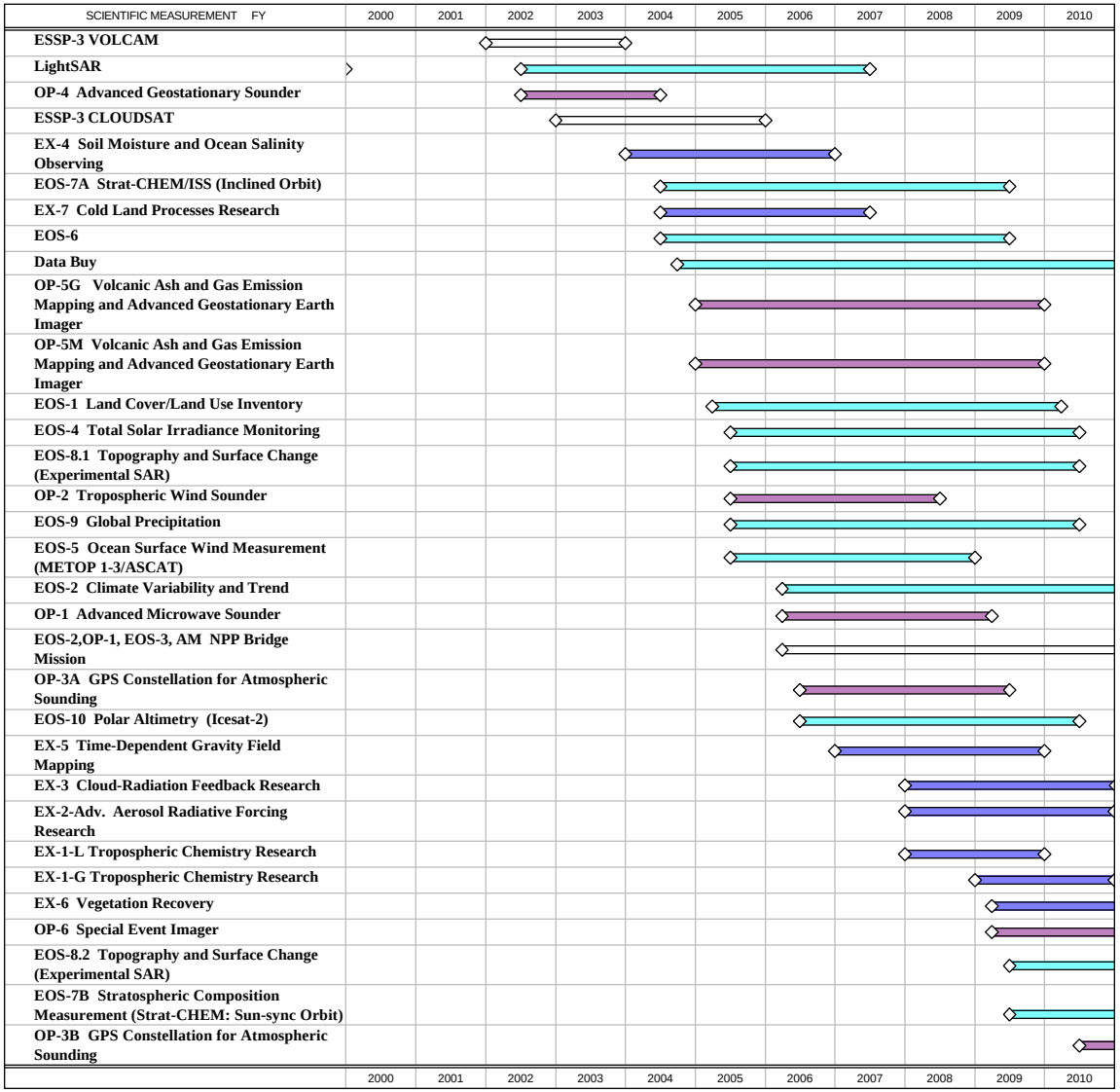
ESE Measurement Scenarios (BMPS)

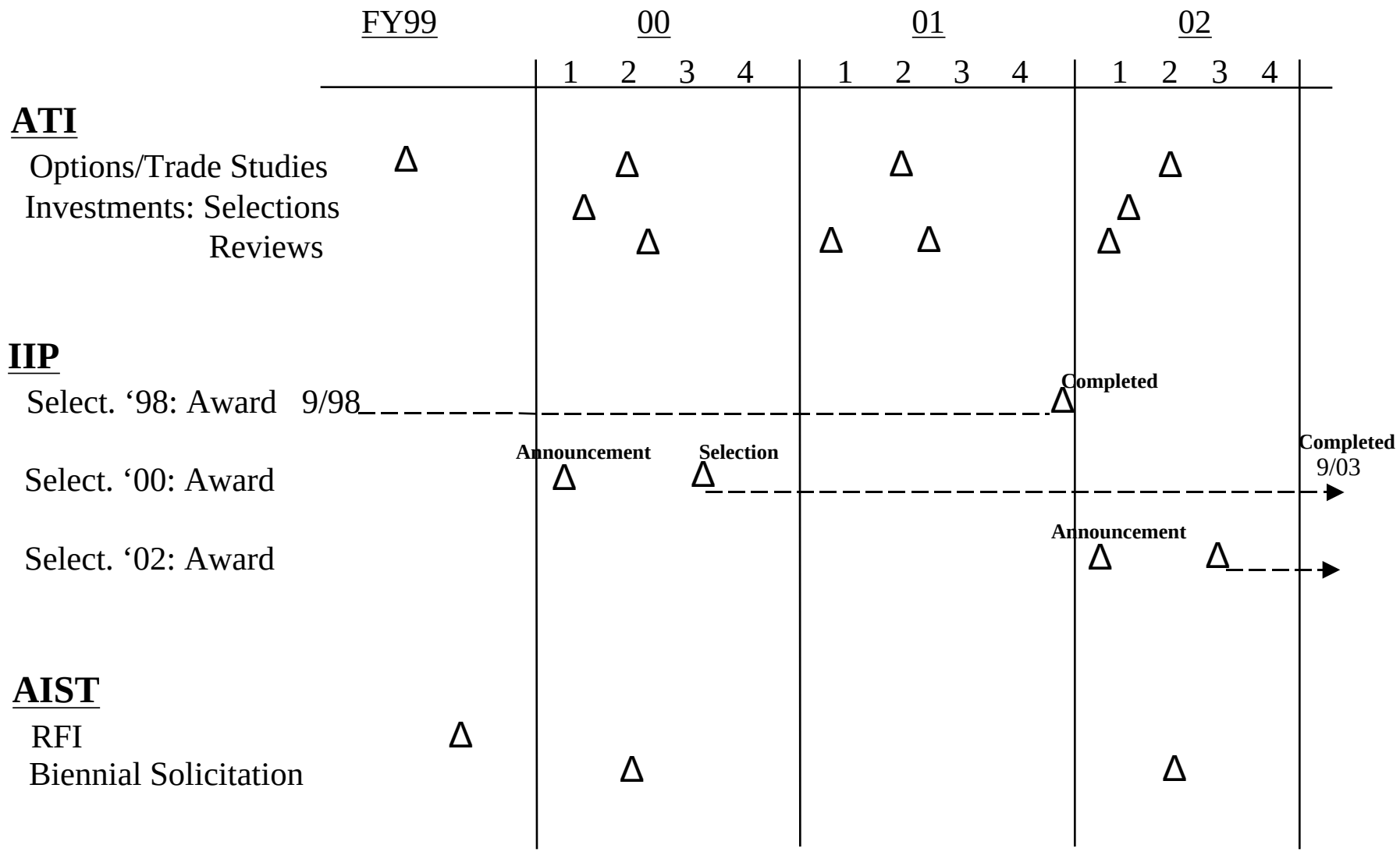
SCIENTIFIC MEASUREMENT FY	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
7. Ocean and Ice											
7.1 Ice Sheet Mass Balance											
Icesat-1		◇					◇				
EOS-10 Polar Altimetry (Icesat-2)							◇				◇
7.2 Ocean Color Mapping											
EOS-AM/MODIS	◇					◇					
EOS-3 Global Terrestrial and Oceanic Productivity				<NPP Bridge Mission>							
OP-6 Special Event Imager										◇	
7.3 Ocean Surface Topography											
TOPEX	◇		◇								
Jason-1		◇					◇				
EOS-6					◇						◇
7.4 Ocean Surface Wind											
QuikSCAT	◇				◇						
ADEOS-2		◇					◇				
EOS-5 Ocean Surface Wind Measurement (METOP 1-3/ASCAT)						◇			◇		
7.5 Sea Surface Salinity (see 4.3 above)											
7.6 Ocean Surface Temperature											
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010

Current
EOS - Systematic
EX - Earth Probe Exploratory/Focused
OP - Pre-operational

ESE Measurement Scenarios (BMPS) Sorted

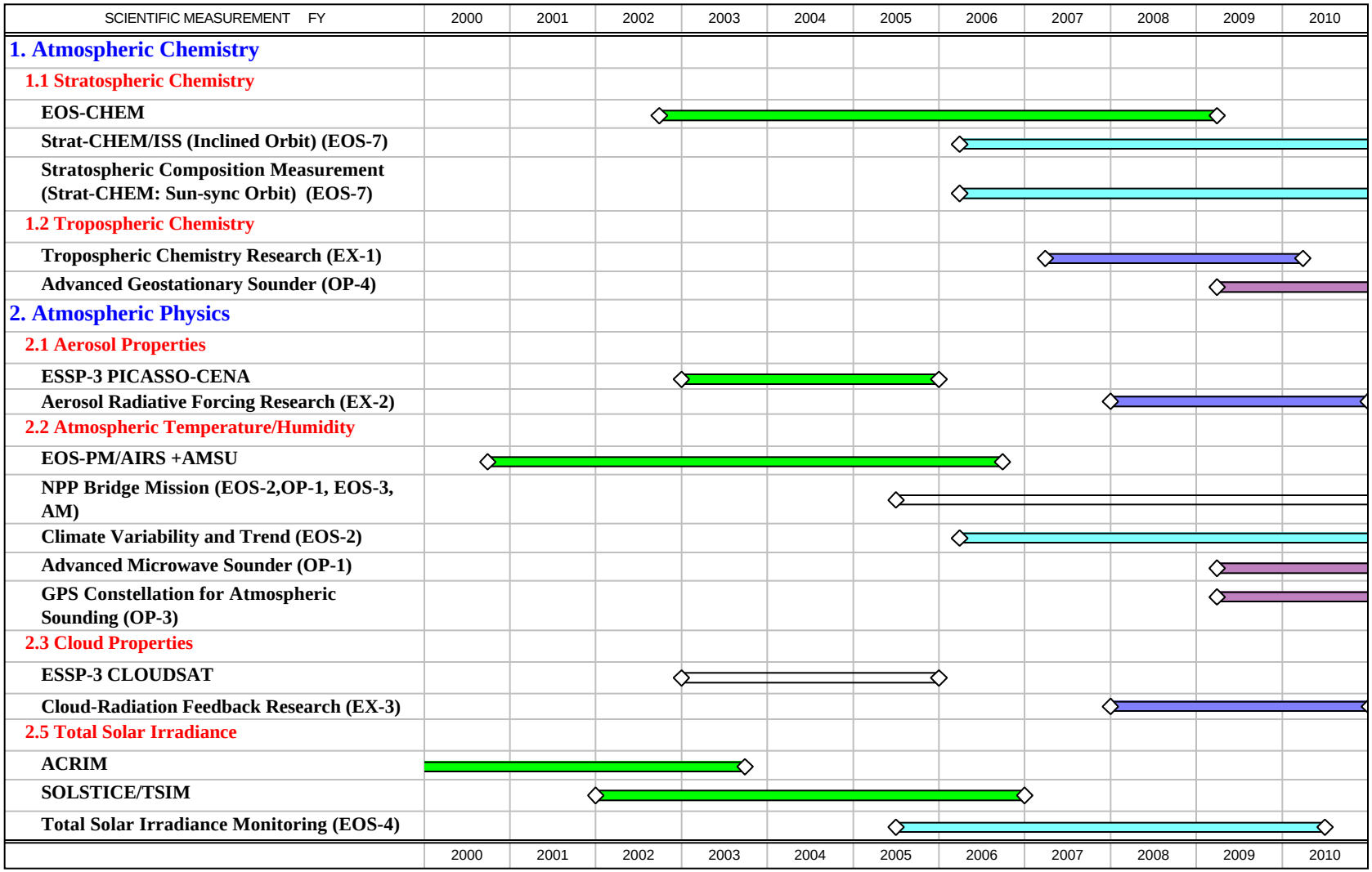


ESTO Solicitation Schedule

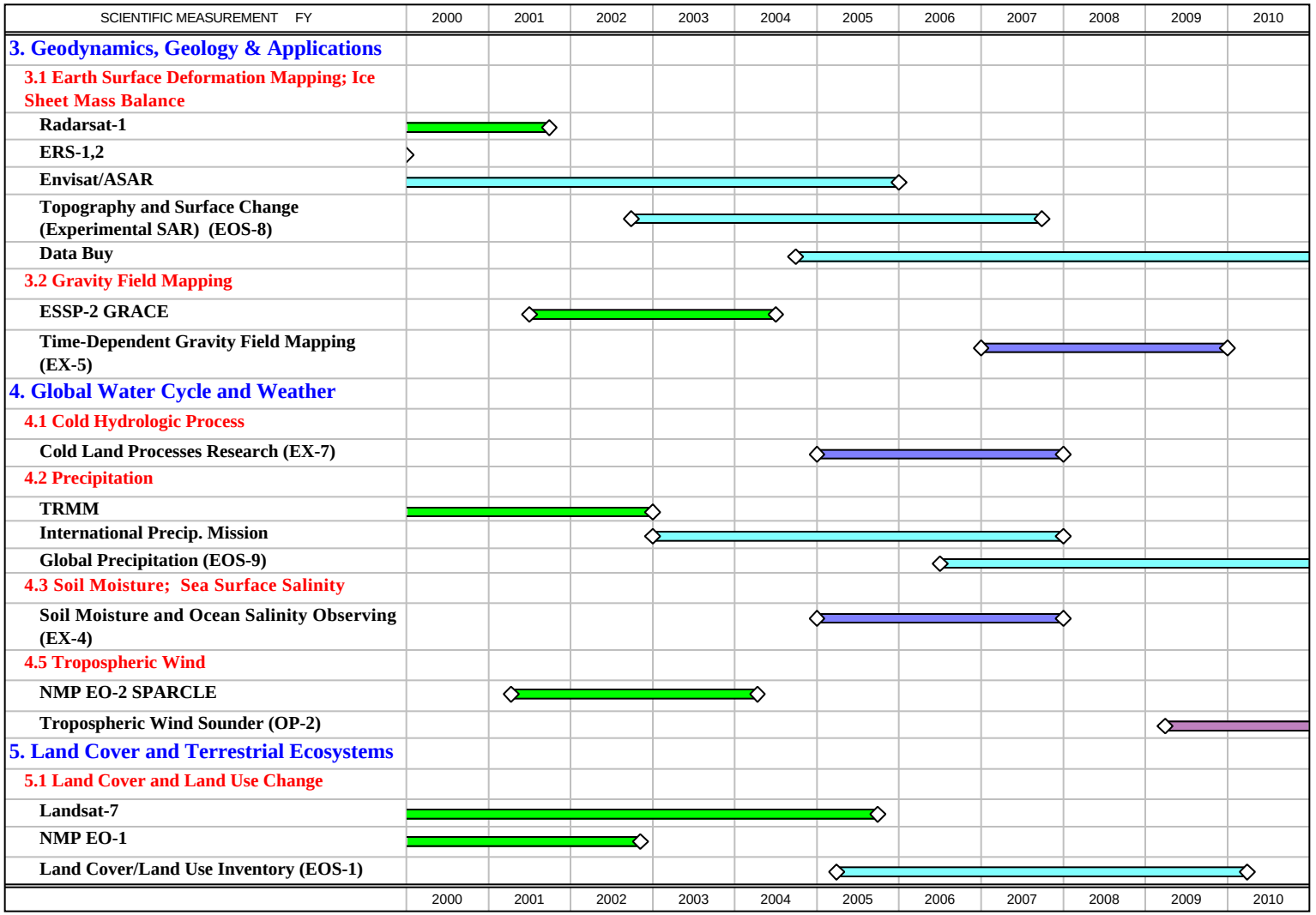


Backup

ESE Measurement Scenarios (Easton)



ESE Measurement Scenarios (Easton)



ESE Measurement Scenarios (Easton)